



# STP36NF06L STB36NF06L

N-channel 60V - 0.032Ω - 30A - TO-220 - D<sup>2</sup>PAK  
STripFET™ II Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP36NF06L	60V	< 0.04Ω	30A
STB36NF06L	60V	< 0.04Ω	30A

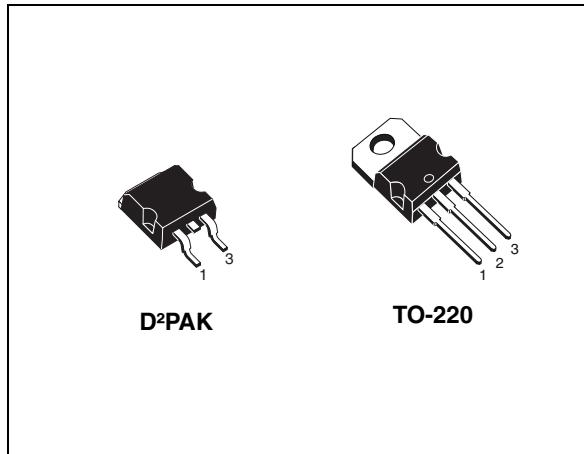
- Exceptional dv/dt capability
- 100% avalanche tested
- Low threshold drive

## Description

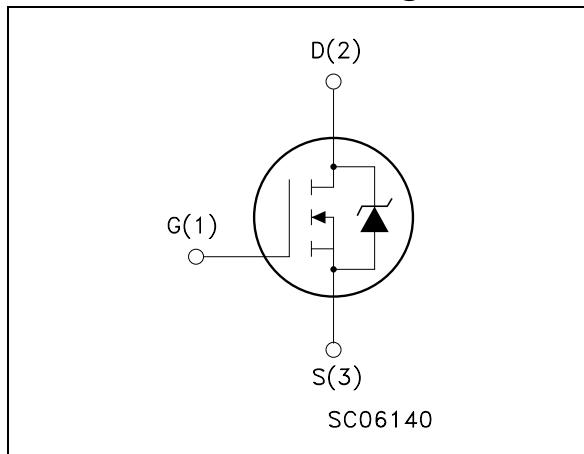
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Sales type	Marking	Package	Packaging
STP36NF06L	P36NF06L	TO-220	Tube
STB36NF06L	B36NF06	D <sup>2</sup> PAK	Tape & reel

**Contents:**

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage ( $V_{GS}=0$ )	60	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS}=20K\Omega$ )	60	V
$V_{GS}$	Gate-source voltage	$\pm 18$	V
$I_D$	Drain-current (continuos) at $T_c=25^\circ C$	30	A
$I_D$	Drain-current (continuos) at $T_c=100^\circ C$	21	A
$I_{DM}^{(1)}$	Drain-current (pulsed)	120	A
$P_{TOT}$	Total dissipation at $T_c=25^\circ C$	70	W
	Derating factor	0.47	W/ $^\circ C$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	10	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	225	mJ
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	$^\circ C$

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 30A$ ,  $di/dt \leq 400A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ .  $T_j \leq T_{jmax}$
3. Starting  $T_j=25^\circ C$ ,  $I_D=15A$ ,  $V_{DD}=30V$

**Table 2. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.14	$^\circ C/W$
$R_{thj-amb}$	Thermal resistance junction-ambient (free air) max	62.5	$^\circ C/W$
$T_I$	Maximum lead temperature for soldering purpose	300	$^\circ C$

## 2 Electrical characteristics

( $T_{CASE}=25^\circ\text{C}$  unless otherwise specified)

**Table 3. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D=250\mu\text{A}, V_{GS}=0$	60			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS}=0$ )	$V_{DS}=\text{Max rating}$ $V_{DS}=\text{Max rating } T_c=125^\circ\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS}=0$ )	$V_{GS}=\pm 18\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS}=10\text{V}, I_D=15\text{A}$ $V_{GS}=5\text{V}, I_D=15\text{A}$		0.032 0.045	0.04 0.05	$\Omega$ $\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$g_{fs}$	Forward transconductance	$V_{DS}=15\text{V}, I_D=15\text{A}$		15		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS}=25\text{V}, f=1\text{MHz}, V_{GS}=0$		660 170 70		pF pF pF
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD}=30\text{V}, I_D=30\text{A}$ $V_{GS}=5\text{V}$		13 4.2 7.8	17	nC nC nC

**Table 5. Switching on/off (inductive load)**

Symbol	Parameter	Test condicions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay Time Rise time	$V_{DD}=30V$ , $I_D=15A$ $R_G=4.7\Omega$ , $V_{GS}=5V$ (see <i>Figure 14</i> )		10 80		ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD}=30V$ , $I_D=15A$ $R_G=4.7\Omega$ , $V_{GS}=5V$ (see <i>Figure 14</i> )		19 13		ns ns

**Table 6. Source Drain Diode**

Symbol	Parameter	Test condicions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)				30 120	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=24A$ , $V_{GS}=0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=20A$ , $V_{DD}=20V$ , $di/dt=100A/\mu s$ , $T_j=150^\circ C$		55 107 3.9		ns nC A

1. Pulse width limited by safe operating area.
2. Pused: pulse duration=300μs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

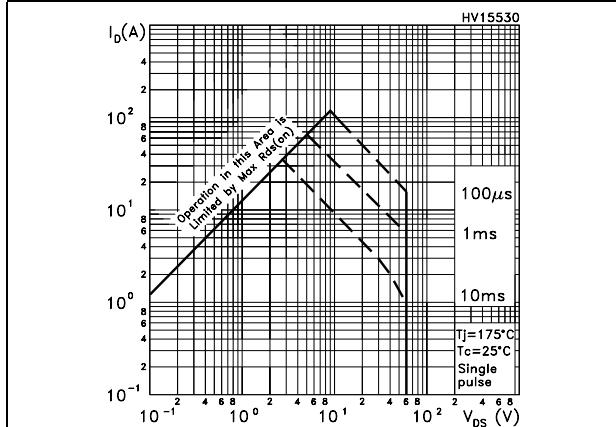


Figure 2. Thermal impedance

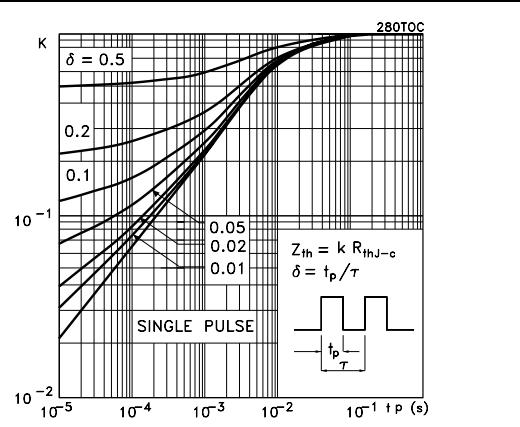


Figure 3. Output characteristics

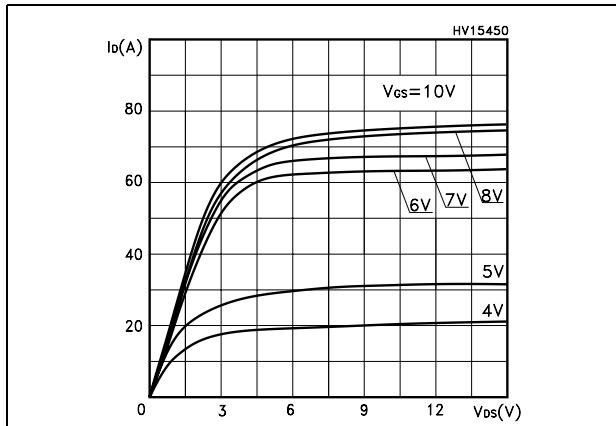


Figure 4. Transfer characteristics

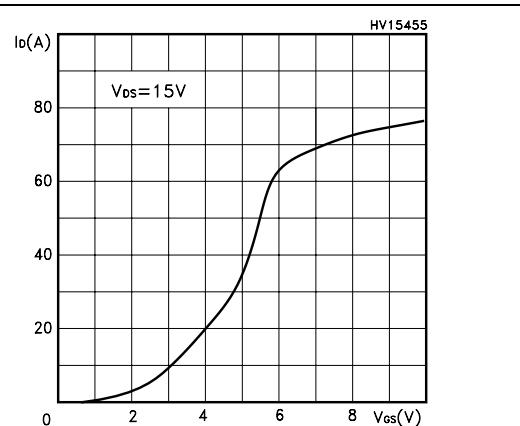


Figure 5. Transconductance

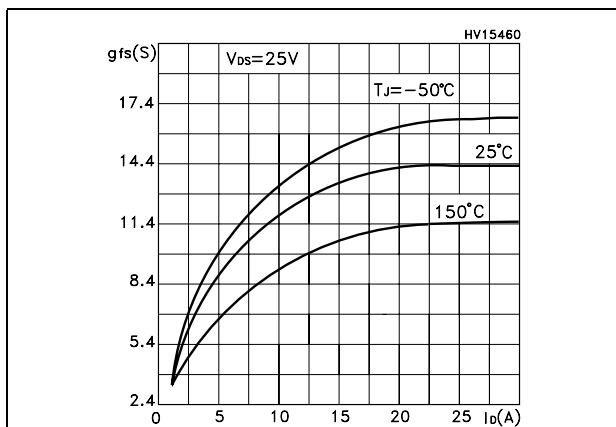
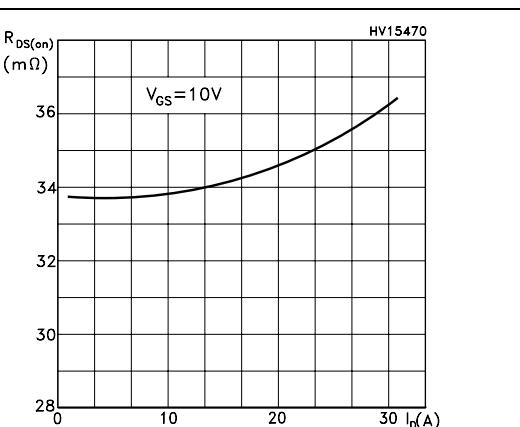
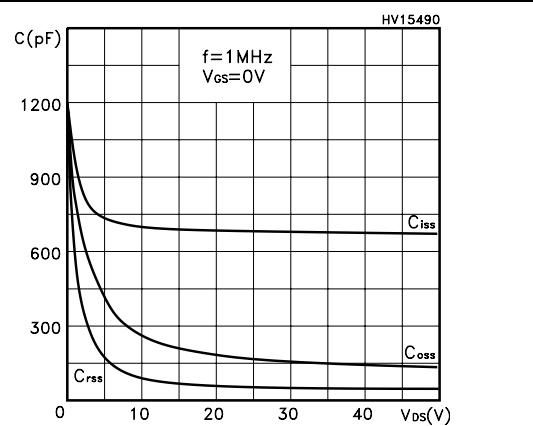
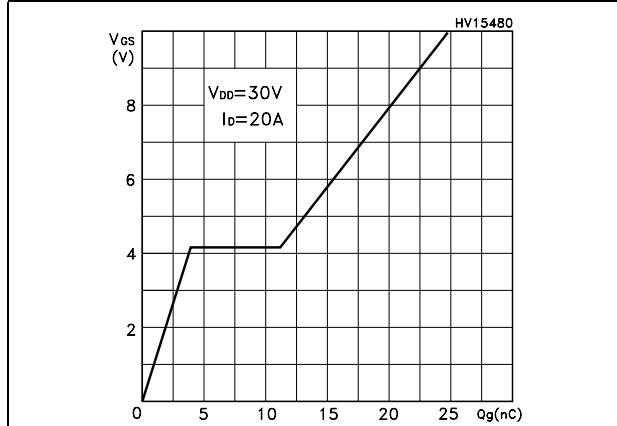
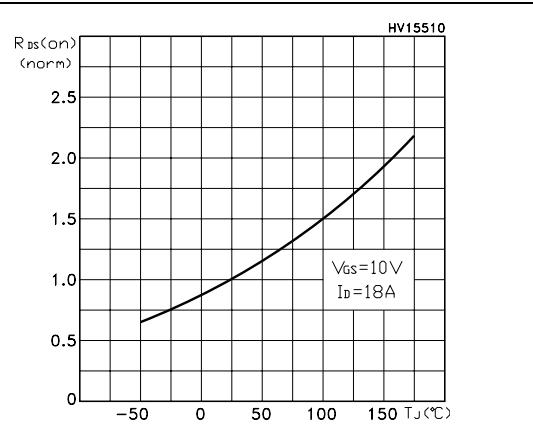
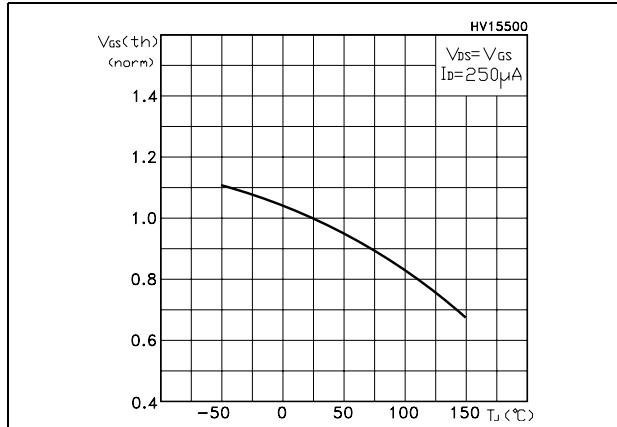
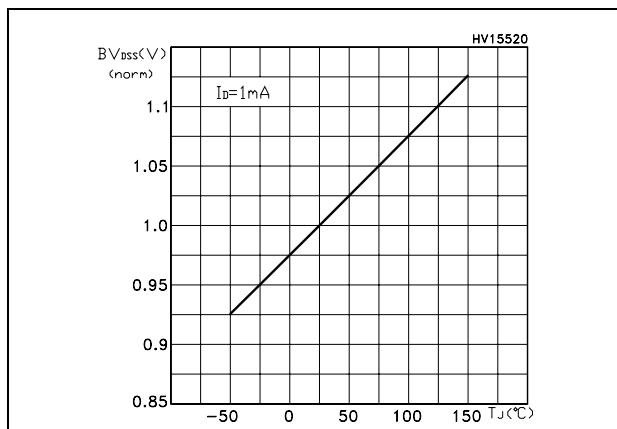


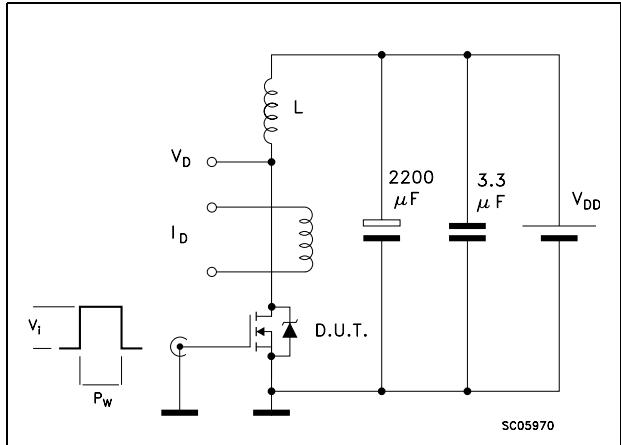
Figure 6. Static drain-source on resistance



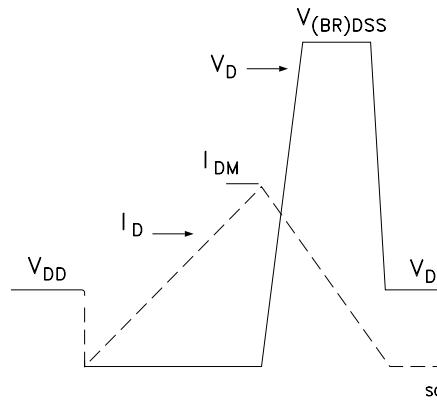
**Figure 7. Gate charge vs gate-source voltage****Figure 9. Normalized gate threshold voltage vs temperature****Figure 11. Normalized  $BV_{DSS}$  vs temperature**

### 3 Test circuit

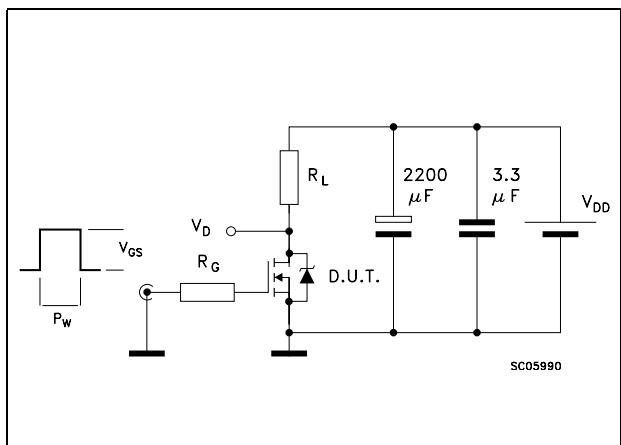
**Figure 12. Unclamped inductive load test circuit**



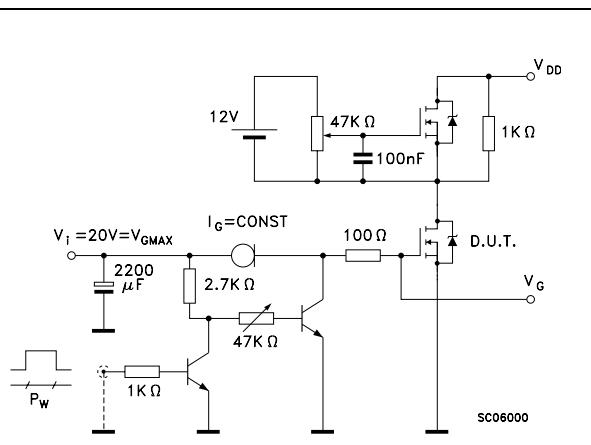
**Figure 13. Unclamped inductive waveform**



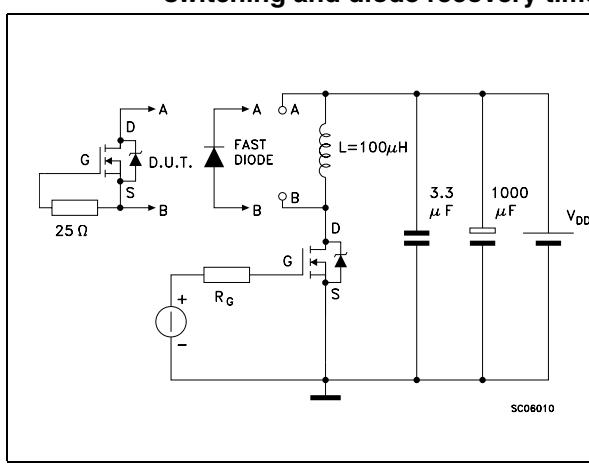
**Figure 14. Switching times test circuit for resistive load**



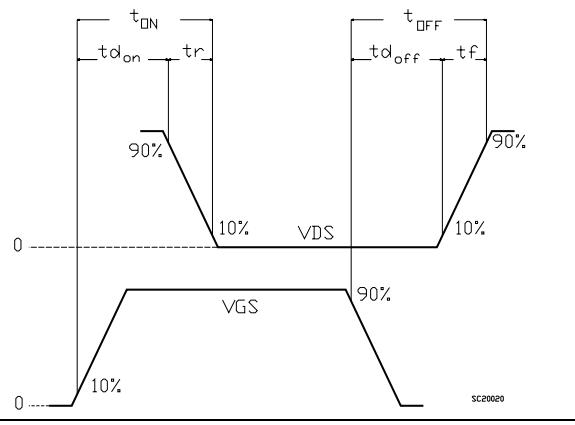
**Figure 15. Gate charge test circuit**



**Figure 16. Test circuit for inductive load switching and diode recovery times**



**Figure 17. Switching time waveform**

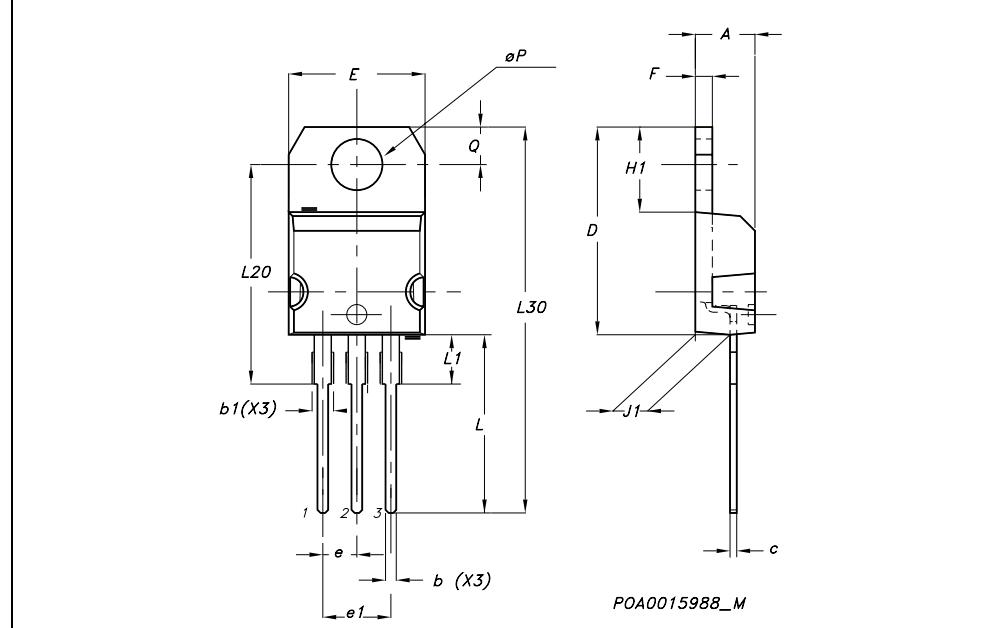


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

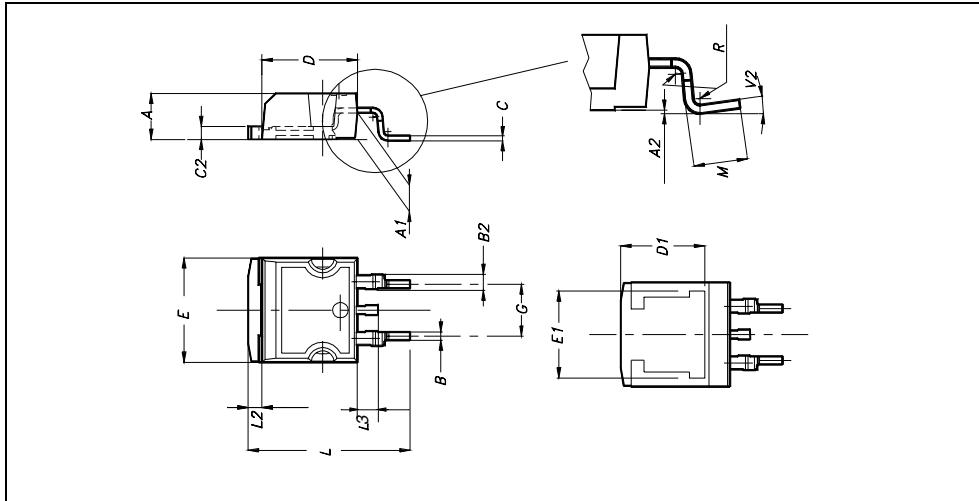
## TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



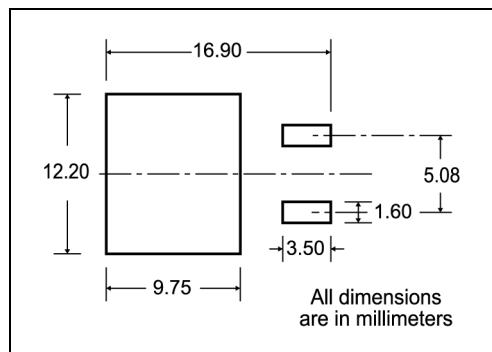
**D<sup>2</sup>PAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			

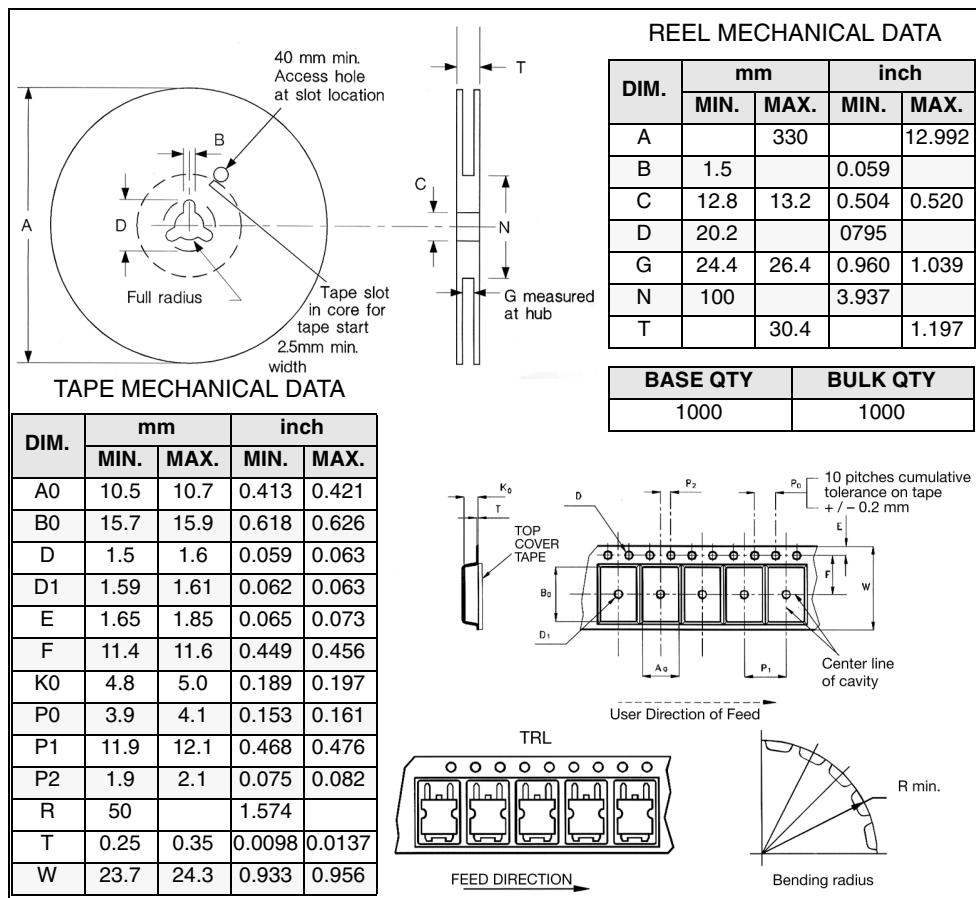


## 5 Packaging mechanical data

### D<sup>2</sup>PAK FOOTPRINT



### TAPE AND REEL SHIPMENT



\* on sales type

## 6 Revision history

**Table 7. Revision history**

Date	Revision	Changes
14-Jun-2003	1	First release
13-Mar-2006	2	Complete version
26-Jun-2006	3	New template, no content change

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